# A Shared Future: Transboundary Water Concerns in the Jordan River Basin

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**ABSTRACT**

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In the context of the Israeli-Palestinian conflict, there is one feature of the natural landscape that serves as potential grounds for regional collaboration: water. Its scarcity has plagued generations of Israeli and Palestinian users, its significance has inspired a body of cultural products, its necessity has ensured advancements in infrastructure and technology, and its control has often determined who may cultivate the land. This paper examines each of these defined areas before focusing on two organizations of water diplomacy, EcoPeace Middle East and the Arava Institute for Environmental Studies. EcoPeace employs a bottom-up approach to empower Israelis and Palestinians to demand solutions to local water issues, and a top-down approach focused on the publication of policy briefs. The Arava Institute addresses environmental challenges through the collaboration of riparian communities, and offers Israelis, Palestinians, Jordanians and other international participants the opportunity to conduct research at Kibbutz Ketura on the Israeli side of the Arava Valley. These organizations promote collaboration on water issues in the Jordan River basin that will affect generations of water users. However, this thesis will encourage both organizations to explicitly address the contrasting water histories of Israelis and Palestinians, as reflected in Israeli and Palestinian literature and culture, in order to effectively foster collaboration in the long-term future.

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## Introduction

The creation of the State of Israel in 1948 catalyzed a geopolitical conflict in the Middle East which resulted in an invasion by surrounding Arab states.[1] Hoping to prevent the establishment of the Jewish state, the five Arab nations acted in support of the Palestinian cause for self-determination.[2] The ensuing Israeli victory did not silence territorial disputes over claims to the land and regional tensions have persisted well into the 21st century.[3] No comprehensive picture of this conflict in the Jordan River basin would not be complete without consideration of one feature of the natural landscape: water. The Jordan River touches many territories: Israel, the West Bank, Lebanon, Jordan, and Syria. Conflict over shared water sources is not unheard of for these riparian areas.[4] One such example is the story of Eli Cohen, perhaps Israel's most famous spy. Cohen is remembered for his infiltration of the Syrian government and the intelligence he gathered under the alias of Kamel Amin Thaabet, a fabricated Arab businessman.[5] After forming close relationships with high-ranking government officials, Cohen warned Israel of a Syrian plot to strike the country's National Water Carrier.[6] While the Syrian attack was thwarted, the transgression alludes to the significance of efficient water resource management in the arid region. When a country loses the ability to control its water sources, it also loses the ability to effectively cultivate and govern the land.[7]

Due to the region's geographical position, water scarcity remains an acute concern for all states.[8] However, despite regional tensions and mounting environmental pressures, water serves as potential grounds for regional collaboration.[9] In this thesis, I argue that non-governmental organizations focused on collaboration must address water's central role in the intimate everyday life of the region's people as reflected in Israeli and Palestinian literature and culture. My thesis will first explore the historical and cultural role of water in the Lower Jordan River basin,

specifically focusing on the Israeli and Palestinian narrative. These two sections are crucial for understanding the events which led to the current relationship between Israelis and Palestinians as far as water is concerned. The first section, which will examine the history of water in Israel, will focus on the creation of the National Water Carrier and Article 40 of the Oslo II Accords. Through an analysis of two poems, the second section will compare the recurrence of water as a theme in Israeli and Palestinian literatures and the ways these cultural products speak to the national identity of both peoples.

Next, I will discuss the existing water infrastructure in Israel which enabled the country to become an international water superpower. Desalination technologies became a lifeline in the drought prone country, allowing agriculture farms to thrive even during the dry season.[10] In the following section, I will examine transboundary water issues and water diplomacy with a focus on the water issues faced by Palestinians in the Gaza Strip and the West Bank, the future of Palestinian agriculture, and the Red Sea-Dead Sea Canal negotiation with Jordan. Lastly, I will explore two organizations of environmental peacemaking and water diplomacy that invite all parties to discuss their shared future, EcoPeace Middle East and the Arava Institute of Environmental Studies. These groups, which promote transboundary water management and cooperation, offer a framework through which different communities can work together with the goal of creating a sustainable future for Israeli, Palestinian, and neighboring Jordanian water users. However, this interdisciplinary thesis will identify that EcoPeace and the Arava Institute require additional efforts to discuss differing Israeli and Palestinian perspectives among program participants.

## Part I: The History of Water Policy in Israel

Israeli water policy developed differently in three periods over the past 75 years. A first stage was state-supported expansion of agriculture and water resources between 1948 and 1964 (Hydraulic Mission).[11] A second stage was the priority of agricultural expansion over water resource conservation between 1959 and 1990 (Wise Management).[12] More recently, Israel has developed new perceptions of water-management and mass desalination between 1990 and 2005 (Reflective Deliberation).[13]

During the late Hellenistic and Early Roman periods, Jerusalem's ancient water systems were composed of aqueducts that carried water from streams, surface rainfall, and tunnels connected to aquifers.[14] The Upper Aqueducts served Jerusalem between AD 70 and the Byzantine period.[15] While it is unknown whether or not the system stayed in continuous use throughout the centuries, there is evidence that the Ottoman Empire laid clay pipes in 1541 and attempted to restore the Lower Aqueduct in 1871.[16] Once the British Mandate Government seized control of the territory in late 1917, they began to improve the water structures that they found in Jerusalem. The British-Palestine Mandate of 1922 established the United Kingdom as the authoritative body in control of the region and also recognized the Jewish people's historical connection to the land.[17] While there was no mention of water in the Mandate, national agencies such as the Palestine Electricity Corporation emerged. In 1926, British authorities approved the Jewish-owned business' attempt to generate electricity through access to the Jordan and Yarmouk rivers.[18] While the plant ceased to operate in 1948, the hydroelectric station served as an early example of the potential of nation-building infrastructure.

Transitioning into the 1930s, questions began to arise as to how Palestine could support the influx of Jewish migration. Fresh water availability and land capacity became the two

primary areas of uncertainty as British economists believed that the geographic area of Palestine couldn't withstand mass migration. The 1939 White Paper limited Jewish migration to Palestine to about seventy-five thousand people over the course of five years.[19] Around the same period, the first plans to assess the potential of the Jordan River as a water resource for irrigation were also devised. According to scholars, the Ionides Plan of 1939 contained three goals:

> (1)Yarmouk River floodwaters would be diverted along the East Bank of the Jordan River and stored in the Sea of Galilee
> (2) Stored water, along with a small quantity of Yarmouk River water, would be diverted to a new canal (the East Ghor Canal) to provide irrigation for lands east of the Jordan River
> (3) Irrigation water of the Jordan River would be used primarily within the Jordan River Basin.[20]

Zionist leadership continued to brainstorm strategic ways to innovate the allocation of water resources in Palestine and demonstrate that the region could indeed withstand mass migration. During this period, water accessibility was a local matter as there was no communal water resource for the entire region. Simcha Blass, a water engineer and central figure of Israeli water planning, drafted a three stage plan that would eventually evolve into Israel's National Water Carrier. He proposed drilling below the surface of the Negev Desert to extract water for agricultural purposes, pumping water out of the Yarkon river, and creating a water carrier to bring water from the plentiful north and distribute it to the water-poor areas in the south.[21] Another plan for the region, *Palestine: Land of Promise*, was published in 1944 by American soil scientist Walter Lowdermilk, making a case to divert water from the Litani and Yarmouk rivers to the Jordan Valley and the Negev.[22] Lowdermilk's book promoted the idea that Palestine could make maximum use of its water sources in order to accommodate the migration of Jewish refugees.[23] James Hayes, an American engineer, built upon Lowdermilk's ideas in his book, *TVA*

*on the Jordan*, which proposed various restructures of the Jordan River such as the use of flood water irrigation the Negev and drainage canals to control flood water and recharge aquifers.[24]

***1950s to early 2000s***

In 1948, the United Nations voted to divide the geographical region into Jewish and Palestinian areas, subsequently establishing the State of Israel. In the three years that followed, over 685,000 immigrants arrived in Israel, and the need to provide food, employment, and water for the newcomers became a central objective of the Israeli government.[25] In 1952, the United Nations Relief and Works Agency enlisted the TVA to create a unified plan intended to alleviate water conflicts between riparian states on the Jordan River. The drafted plan contained specific goals to drain the Hula marshes in the Galilee region, build dams on the Hasbani Steam and Yarmouk River, construct the Med-Dead Canal, divert the Yarmouk River water into the Sea of Galilee, and ensure that irrigation would be dictated by gravity flow due to the mountainous topography of the region.[26] Despite the progress demonstrated by this proposal which addressed concerns of the riparian states, there remained a need for a comprehensive plan regarding usage of the Jordan River. The United States enlisted Eric Johnson, the head of the Motion Picture Association of America, who had experience in international discourse, to lead the effort. After disagreements among the riparian states broke out over disputed elements of Johnson's initial resolution to dissolve water tensions, a modified plan was drafted which incorporated agreed upon engineering structures and interbasin transfers limited by the size of water allocations.[27] While accepted and unofficially followed by all parties for a period of time, the Johnson Plan was never signed by Arab states as it could have been interpreted as an official recognition of the State of Israel.[28] At the time, Palestinians living under Jordanian control were grouped under the

allocation for Jordan, a fact that would later complicate construction of a Palestinian water system because no clear Palestinian share was allocated.[29] Following United States intervention with the Modified Johnson Plan, Israel re-evaluated its design for other possible avenues of water infrastructure. In 1995, the state finished construction of a water pipeline stretching from Tel Aviv's Yarkon River to the northeastern Negev, allowing for the cultivation of fifty thousand acres of desert land.[30] Figure 1 illustrates the extent to which the National Water Carrier extends throughout the country.

*Figure One: The National Water Carrier (2019)*

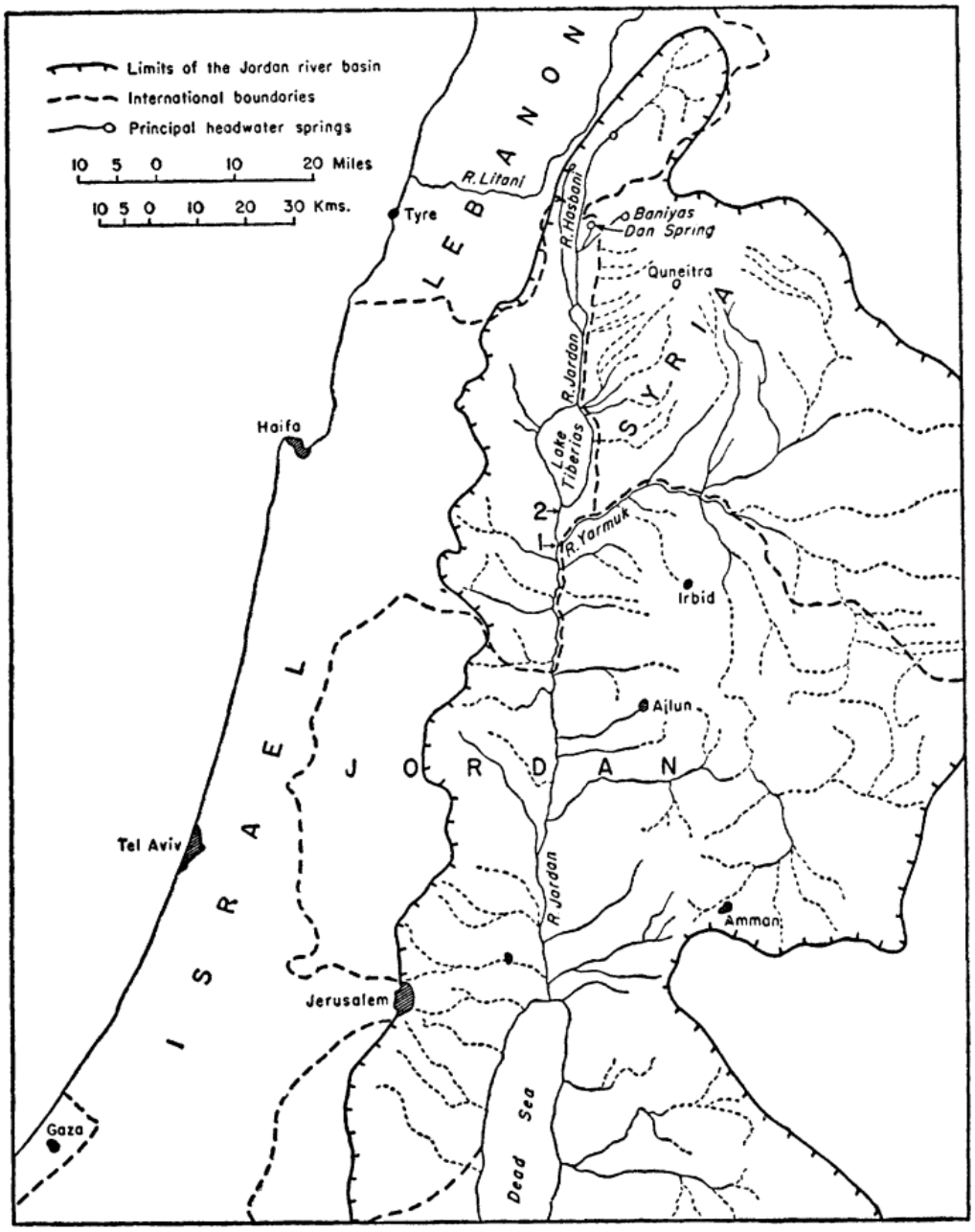

**Source: Brooks, Trottier, and Giordano, *Transboundary Water Issues in Israel, Palestine, and the Jordan River Basin: An Overview*, 14.**

Implementation of a National Water Carrier that would function as an underground plumbing system stretching from north to south followed suit. With the responsibility of pumping 120 billion gallons of water through its network, it was crucial that the pipeline was able to endure an array of climates and altitudes.[31] Once functional, the success of the National Water Carrier allowed for more cities to prosper in the Negev as the limitations of a water-limited region began to shrink and communities of new immigrants could become farmers.[32] With the passing of the 1959 Water Law, which centralized ownership and control of the nation's water sources, a water commission was established to develop national water policy.[33] The Water Law recommends the prioritization of water uses as follows: water for drinking purposes, agriculture, industry, handicraft, commerce and services, and public services.[34] Following the completion of the National Water Carrier and the establishment of the Water Commission, Israel turned its attention to governing the national water system. Originally, different cabinet ministries were able to claim different roles of water governance, but in 2006 the Water Commission, renamed the Water Authority, moved under the Ministry of Energy and was given its own authority to make decisions.

In the mid-1960s, disagreement between riparian states began to arise regarding Israel's diversion of the Dan River, a tributary of the Jordan River.[35] At the first summit of the Arab League in 1964, the Headwater Diversion Plan was devised to divert Jordan headwater streams in Lebanon and Syria to the Litani and Yarmouk tributaries. [36] However, Israeli forces conducted an airstrike on the construction projects in Syria and the diversion plan was halted. Under the suspicions of excessive water diversion, Israel also attacked Jordan's East Ghor Canal in 1969, and the two countries agreed that they would return to the allotments stated in the Johnson

Plan.[37] Figure 2 illustrates the headwaters and boundaries of the Jordan River basin and serves to demonstrate the shared water sources of Israel, Jordan, Lebanon, and Syria.

*Figure Two: The Jordan River Basin (1966)*




**Source: Smith, "The Disputed Waters of the Jordan", 112.**

In 1994, Israel and Jordan reached a peace agreement which contained articles regarding water related issues between the two nations. Jordan would be permitted to store 20 million cubic meters ($m^3$) in the Sea of Galilee during the winter months and would retrieve the water during the summer months.[38] The two countries also approved Jordan's construction of a dam on the Yarmouk River, downstream of any diversion to the Jordan River. Furthermore, Jordan would receive 10 million cubic meters ($m^3$) of desalinated water from Israel's saline springs.[39] Overall, the treaty managed to deliver a comprehensive and definitive plan for the settlement of water problems which delegates hoped to see replicated in Israeli-Palestinian discourse. Israeli delegates and the Palestinian Liberation Organization (PLO) would come together to form their first official agreement in 1993 with the Declaration of Principles, which included some terms for water allocation.[40] The PLO established a Palestinian Water Administration Authority (PWA) and agree to cooperate with Israel on a jointly established a water development program that aimed to:

> specify the mode of cooperation in the management of water resources in the West Bank and Gaza Strip, and w[ould] include proposals for studies and plans on water rights of each party, as well as on the equitable utilization of joint water resources for implementation in and beyond the interim period.[41]

Acting as a first step towards addressing Israeli and Palestinian concerns, the Declaration was meant to be built upon by the Interim Agreement that would take place in the following years.

### *Oslo II: Article 40 and the Interim Agreement*

In 1995, The Taba Interim Agreement (Oslo II) Article 40 marked the development of a new era of Israeli-Palestinian relations. With the formation of the independent agency Palestinian Water Authority (PWA) the agreement established Israel's partial recognition of Palestinian

water rights in the West Bank.[42] It was also determined that West Bank allocation would be limited to between 70 and 80 million cubic meters ($m^3$) per year which would come from Israel's own supply and the eastern aquifer, with the nature of the water having both agricultural and domestic use.[43] The PWA would be responsible for all water resources under PA control, regulate usage through the issuing of permits for approved amounts of water, prepare regional water plans, participate in efforts to develop new sources of water supply, and improve the centralization of hydrological data.[44] Oslo II also called for the formation of a Joint Water Committee (JWC) of Israelis and Palestinians which would specifically handle water and sewage issues in the West Bank.[45] Responsibilities of the committee include licensing water installation devices, monitoring water extraction and providing limitations on extracted volume, and coordinating the implementation of new utility infrastructure.[46] A secondary joint Israeli-Palestinian-American committee was also proposed to provide mediation and facilitate projects of the JWC.[47] The JWC became an optimistic mechanism for amicable relations between the two parties, especially when other non-water related task forces failed to cooperate in the face of the intifadas of the 2000s. The Israeli Civil Administration supervises the work of the JWC, but obstacles remain for the approval of infrastructure projects. In one case, the JWC didn't meet for seven years because of the PA's refusal to approve Israeli water projects for new settlements.[48] In 2017, the revival of the JWC came with some new demands from both Israel and Palestine. It was established that Palestinian infrastructure projects in the West Bank located in areas that are majority Palestinian could seek approval from the Civil Administration without first running their projects past the JWC.[49]

The PWA, though lacking the authority and power of the Israeli Water Commission, drafted Palestinian Law No. 3 in 2002, which paralleled Israel's Water Law of 1959 by

determining water to be public property owned by the Palestinian people.[50] Tasked with planning and developing a new water policy and water infrastructure for a future state of Palestine, the PWA recognized the need to rebuild wells destroyed in the 1967 war and accommodate the 50 percent of West Bank villages that lacked piped water.[51] Israel Military Regulations largely influences water utilization and the development of new infrastructure in Palestinian territories. Military Order No. 158 of 1967 states that all wells, springs, and water projects are to be under direct control of the Israeli Military Governor and Military Order No. 291 of 1968 asserts that the ownership of Palestinian water resources would be public rather than private in accordance with Israeli water law.[52]

While Oslo II recognized some water rights and created a dialogue regarding transboundary water issues between Israel and Palestine, its language created ambiguities that would complicate water negotiations for years to come. The Interim Agreement itself was meant to be a temporary solution until final negotiations could take place within the following five years. Israel and the Palestinian Authority continue to operate under the agreement without addressing the final status of Palestinian water rights. Two crucial lingering questions of Article 40 remain in regard to what qualifies as an adequate water supply for Palestinians and how should approval of extraction of shared water be addressed.[53] The former question has been deliberated by Israeli researchers who believe that Palestinians may be under exploiting the Eastern Basin of the Mountain Aquifer or not taking advantage of sewage reuse infrastructure. With respect to over-extraction of shared water sources such as the Mountain Aquifer, Article 40 specifically dictated that Israel would have a withdrawal rate of 483 million ($m^3$) and Palestine would receive 182 $m^3$.[54] However, since this agreement, Israel has been noted to over-extract from the Western Basin of the Mountain Aquifer and drill into the aquifer in places where the

Joint Water Commission has no jurisdiction.[55] Bureaucratic obstacles in Gaza and the West Bank make the timeline for water infrastructure projects indefinite. It is additionally difficult for Palestinians to build sufficient water infrastructure because of the lack of funds available for such projects. Problems with the authority of the JWC continue to appear when one looks at the vagueness of some mandates in Oslo II. For example, there is no mention of Palestinian access to the Jordan River. There are also no details as to how the JWC is supposed to share its data findings and solve water-related conflicts in the region. There is also the issue of the current division of the West Bank, as the region was separated into three areas and placed under the supervision of either the Palestinian Authority, Israel, or both. Furthermore, there was no distinction made in Oslo II as to the difference between water use and water consumption, which complicate water reuse plans. Furthermore, Oslo II did not consider Israel's emphasis on desalinated water as a water source. The new wave of water technology in Israel has been used to deal with the frequency of droughts, Palestinian and Jordanian claims on water, new efforts to be environmentally mindful of water consumption, and the declining presence of the agriculture sector as one of the largest water consumers.[56] The new water technologies and infrastructure which currently support the agriculture industry and Israeli and Palestinian households will be discussed in Part III.

## Part II: Water in Cultural Productions

The recurrence of water in Israeli and Palestinian literatures reflect the centrality of this issue in both cultures. These cultural productions engage with salient themes such as conditions of water scarcity as they relate to the cultivation of a national identity.

In the Hebrew texts, one pattern which emerges is the emotional attachment to the physical landscape. In Amos Oz's *The Same Sea (1999),* a Hebrew text which alternates between poetry and prose, the sea acts as a symbol of home for an Israeli boy who leaves for Tibet following the death of his mother. The text ultimately serves as a means of consolidating sea and land to form a complete and romanticized representation of the homeland.[57] As mentioned by *The Guardian* writer Jonathan Freedland, *The Same Sea* is "avowedly, a work of art, not politics - a break from the din of the conflict, and a journey into the quieter, more elusive terrain of the heart."[58] These sentiments similarly appear in Meir Shalev's Hebrew text *The Blue Mountain* (1998). Set in the Israeli village of Nahalal, the novel documents the transformation of the Jezreel Valley into a fertile landscape through the perspective of three generations. The efforts of early pioneers to cultivate the swamp land of Palestine are valorized and romanticized, even as the threat of malaria plagues the settlements.[59] A devotion to the landscape is illustrated by the villagers' refusal to abandon Nahalal in the face of an all-consuming disease that aggressively infects the Jewish population. Juxtaposed with these "poisonous swamps" is the symmetrical and organized agricultural management of the land through irrigation channels and perfected by later generations of villagers.[60] This control over the landscape, which is enabled by the control of water sources, intensifies the village's bond with the terrain as the population is finally able to flourish.

On the other hand, the Arabic texts engage with water through the lens of tragedy. In Mourid Barghouti's Arabic text *I Saw Ramallah* (2000), an exiled man returns to his village after nearly thirty years and is horrified to see how the River Jordan has diminished during his absence, convinced that "Nature had colluded with Israel in stealing its water".[61] The transformation of the landscape is consistent with the man's own turmoil as he reconciles his memory of the river with its present-day state. According to one scholar, the text is an "immediate human experience" which sets the stage for making the man's encounter with the river a "genuine existential situation" as he comes to term with the water's state.[62] This theme comparably appears in Ghassan Kanafani's Arabic short story "Men in the Sun" (1963). The text follows the journey of three Palestinian refugees who, while escaping to Kuwait, tragically suffocate while hiding in an empty water tank. The water tank, which began as a symbol of hope for the men looking to start a new life in Kuwait, transformed into the enabler of their imprisonment and eventual death.[63] As one critic pointed out, "water is the main element of life, but in this novel [Kanafani] deliberately made the tank empty of water, as if it were empty of life" which foreshadowed the tragedy that awaited the men.[64]

Beyond the literary, other cultural representations of water include films such as Tawfik Abu Wale's *Thirst (*2004) and Baruch Dienar's *They Were Ten* (1960), demonstrating the broad body of cultural works to examine on the topic. *Thirst* is the story of a family living on an abandoned Israeli military outpost whose living conditions drastically improve after building an illegal pipeline to their home.[65] As the movie progresses, the family becomes increasingly paranoid of their pipeline being sabotaged and begins to take shifts guarding it with guns in hand. The hostile environment reaches its end when the son, Shukri, kills his father who is attacking the pipeline out of spite. Desperate to maintain their water source, Shukri is driven to commit the most

atrocious of crimes. On the other hand, *They Were Ten* tells the story of ten Russian settlers striving to build a life near the Sea of Galilee. Attempting to lay roots and reconstruct an abandoned farmhouse, the group is challenged by their antagonistic Arab neighbors and a lack of accessible water.[66] This nationalistic film serves to represent the difficulties met by early pioneers who were adamant about transforming their ideological goals of nation building into reality.

In this section I will highlight the centrality of water in Israeli and Palestinian culture by focusing on two poems, "A River Dies of Thirst" by the Palestinian poet Mahmoud Darwish (2007) and "Once I Wrote *Now and in Other Days*: Thus Glory Passes, Thus Pass the Psalms" by the Jewish Israeli poet Yehuda Amichai (1998). Though short, these poems allow for a rich understanding of water's role in Israeli and Palestinian culture. These particular poets were chosen not only because of their roles in their respective communities and international reputation, but because their writing overlap stylistically. Darwish and Amichai are recognized as the most significant poets of Palestine and Israel and amassed a huge following throughout their careers. Their works have been featured in Arabic and Hebrew magazines, literary journals, and newspapers, and drew international attention once translated to English. The translations of their works have enabled scholars, critics, and readers outside of the Middle East the opportunity to engage with contemporary Hebrew and Arabic poetry. Stylistically, they each rely on traditional poetic mechanisms to convey and reflect on their own experiences in the shared region. I will begin with an independent analysis of each poem before examining what the two perspectives reveal about the attitudes of each culture in relation to water concerns. My analysis of these two poems will show that Israeli and Palestinian attitudes toward water are similar in some respects and different in others. Darwish's poem indicates that the Palestinian existence is

linked to the unrestricted movement of water, and any interference with that organic activity is a disruption to the balance of nature. Amichai's poem also engages with the concept of the balance of nature, but rather embraces disruption as an inevitable feature of that balance. This comparison suggests that, though the particular conclusions of these associations with water may differ, they remain the basis for gaining a better of understanding of national identity.

I. Mahmoud Darwish, "A River Dies of Thirst"

Mahmoud Darwish was born in British-controlled Palestine in 1941 in the Arab village of al-Birwa.[67] At the start of the 1948 Arab-Israeli War Darwish and his family fled to Lebanon. Upon their return, they settled in the village of Deir al-Asad under the status of Arab residents of Israel.[68] Darwish used his poetry to express the frustration and anger he held towards Israel's treatment of Palestinians as second-class citizens.[69] As a young writer Darwish joined the editorial staff of the Israel Communist Party's literary journal Al-Jadeed in Haifa.[70] He eventually left the country in 1970 after repeated arrests by Israeli authorities and because he sought an environment to write where he could distance himself from the demands and expectations of his Palestinian audience, who by then had deemed him the most significant poet of Palestine.[71] In 1996, after the signing of the Oslo Accords (1993), Darwish returned to Ramallah, where he served as the director of the Palestine Literary Institute and editor-in-chief of the literary journal *al-Karmel*.[72] *A River Dies of Thirst* (2007), titled *Athar al-farāshah* (The Butterfly Effect) in the original publication, was Darwish's last collection of poems published in Arabic prior to his death. The collection encompasses some of his more personal works of poetry and serves to highlight some of Darwish's intimate reflections regarding the Palestinian experience.[73] One poem from this collection, also titled "A River Dies of Thirst," is presented below:

A river was here
and it had two banks
and a heavenly mother who nursed it on drops from the clouds
A small river moving slowly
descending from the mountain peaks
vising villages and tents like a charming lively guest
bringing oleander trees and date palms to the valley
and laughing to the nocturnal revellers on its banks:
'Drink the milk of the clouds
and water the horses
and fly to Jerusalem and Damascus'
Sometimes it sang heroically
at others passionately
It was a river with two banks
and a heavenly mother who nursed it on drops from the clouds
But they kidnapped its mother
so it ran short of water
and died, slowly, of thirst.[74]

This poem, like many others by Darwish, reflects feelings of loss and grief attributed to the occupation of his homeland.[75] In an interview with the *New York Times* in 2001, Darwish explained, "Palestine is also a metaphor -- for the loss of Eden, for the sorrows of dispossession and exile."[76] In "A River Dies of Thirst" Darwish returns to these same sentiments, but rather than making land the focal point of the piece, he turns his attention to the landscape, specifically a river. The river in question is not named, and this notable distinction quickly differentiates this poem from much of Darwish's earlier works, in which place names are often highly politicized, especially in the context of Israel and Palestine where many place names have been Hebraized throughout time.[77] Nevertheless, it is not hard to imagine that Darwish is describing the Jordan River which flows north to south and borders present-day Israel, the West Bank, and Jordan. In the opening lines, a disconnect forms between the depicted river and its present day form. While detailing the river's movement and geography, Darwish refers to their existence in the past tense. The Jordan River remains a distinct geographic feature in the region to this day, yet Darwish

alludes to its absence. While the river may still exist, the river as he knew it is not; therefore, a disruption must have occurred, though it isn't explicitly named. Once again, Darwish withholds specificities surrounding the events occurring within his poem. The next line reveals that the river, which organically receives its water from drops from the clouds, was "nursed by a heavenly mother." In the Palestinian literary canon, the homeland (*al-watan al-umm*) of Palestine is characterized as female.[78] As one critic notes, such a gendered characterization "resonates across many cultures and not only describes the place of one's birth or origins [i.e. Motherland] but also associates that territory with the fertile, nurturing and domestic qualities of traditional femininity."[79] In Darwish's poem, the heavenly mother serves as the lifeline of the river, and the two are tethered together in a familial bond where the river is a dependent child. Darwish's continued use of the past tense suggests that this relationship has been disrupted and perhaps severed in some way, but no further explanation is given.

As the poem progresses, Darwish deviates from his usage of the past tense, but provides a historical account of the river at what must have been its peak state. The river, which majestically descends from the mountain peaks, is a spirited and human-like force. The anthropomorphizing of the river, which was first illustrated in line three, is strengthened in lines six through eight. First, the river "[visits] villages and tents like a charming lively guest." The welcoming of guests is a fundamental virtue of the Islamic faith. According to the Quran, "Abraham is the 'leader/model for mankind'… [and he] has become the prototype of hospitality."[80] The activity described in the poem indicates that this period of time is celebratory for the people the river passes, as they are able to entertain it as their "guest." In the next line, the river "brings oleander trees and date palms to the valley," two plants that are native to Eastern Mediterranean region. The river and the people of these villages are engaged in a symbiotic

relationship. The bountiful river deposits nutrients for the date plants and oleander trees. Without the river, and without its water specifically, agriculture would be unable to grow, and therefore the presence of these plants is a symbol of the flourishing population that developed along the river's banks. Just as the river is dependent on the heavenly mother to nurse it, the villagers are reliant on the river to provide water and support their livelihood.

The joyful atmosphere of this time period is also emphasized by the river's interaction with the nocturnal revellers. Its message is to "Drink the milk of the clouds / and water the horses / and fly to Jerusalem and Damascus." In Ancient Arabic poetry, the motif of clouds compared to camels is a commonly used metaphor.[81] The Classical poets Abū Qurdūda, Tufayl al-Ghanawī, and Khufāf Nubda all compare the raining of clouds to the milking of a she-camel.[82] As scholars have noted, one of the characteristics of Darwish's poetic enterprise is that he writes independently of the strict themes of any particular poetic period.[83] He uses symbols from early Islamic poetry purposefully in this poem, because the symbolism invokes the attitudes and behaviors of an earlier time, which is crucial in depicting the passage of time as it relates to the history of the river. Time is also significant in the last line of the river's message. The fluidity of travel between these cities is reminiscent of a time where it was possible for people to move freely between Jerusalem and Damascus. If this is the case, then the period being described is most likely pre-British occupation when Palestine was part of Ottoman Syria.[84] Following 1920, France and Britain were confirmed by the League of Nations to be the mandatory powers over Syria, Greater Lebanon, Iraq, Transjordan, and Palestine. With time, the British Mandate would create fortified borders in accordance with agreements made with British allies, permanently disrupting Palestinian society as it existed under Ottoman rule.[85] Prior to the British Mandate, "the population had lived under the authority of the Ottoman State for four centuries, with a high

degree of local autonomy … perfect harmony and total freedom of faith, practice, and education."[86] This fact accords with the poem's description of the flourishing state of the villages along the river.

The last lines of the poem come full circle by repeating the opening lines, but now with the unspoken awareness of the river's great history. Abruptly, the poem concludes with the tragic fate of the river; "they kidnapped its mother / so it ran short of water / and died, slowly, of thirst." What was once an organic and natural process has now been forcibly disrupted. The nameless "they" is in line with the ambiguous nature of the entire poem, and ultimately naming the ones to blame is unimportant. There are certainly actors that Darwish can point to as the source of the river's metaphorical death, but the outcome will always remain that the river, as it had existed, is no more. As noted by scholars, Palestinian writers are "compromised by the events of contemporary history before they are born… the luxury of choosing one's past, of selecting memories, of re-arranging relations that transcend events and external circumstances, is not theirs."[87] The severed relationship between the heavenly mother and the river, and the eventual collapse of the dependent villages, is symbolic of the degradation of pre-colonial Palestinian society. Without explicitly naming any places or peoples, Darwish nevertheless manages to communicate the harsh experience of the Palestinian people because their loss, as Darwish recounts it, went against the natural order of things, just as a river dying of thirst upends the balance of nature. The recurring theme of examining the balance of nature is likewise seen in Jewish Israeli poet Yehuda Amichai's work. While Darwish speaks to the Palestinian experience, Amichai is also concerned with the concept of disruption and uses it to frame his own thoughts about the Jewish Israeli experience.

II. Yehuda Amichai, "One I Wrote *Now and in Other Days*: Thus Glory Passes, Thus Pass the Psalms"

Yehuda Amichai was born in Wurzburg, Germany in 1924 to Orthodox Jewish parents and lived there until 1936 when his family fled to Palestine during Hitler's rise to power.[88] He began writing poetry in 1949 and published his first book *Now and in Other Days* in 1955. The book was "among the first to contain colloquial Israeli Hebrew and marked the emergence of an entirely new style in Hebrew poetry."[89] As one of the most translated Hebrew poets of his time, his work is regarded to be highly accessible through his lyrical usage of ordinary language. Amichai mainly identified with a certain trend of writing that prioritized a feel for everyday language and concrete experiences.[90] Other themes of his poetry include the search for identity as an early immigrant to modern-day Israel and his own musings about the world around him, typically written with a quasi-autobiographical voice. The last of his poetic work published before his death, *Open Closed Open* (1998) is considered one of his greatest literary works for its discussion of the Jewish spiritual tradition and Israel's current anxieties through the lens of his own concerns.[91] A stanza from one poem in the collection titled "One I Wrote *Now and in Other Days*: Thus Glory Passes, Thus Pass the Psalms," which expresses these sentiments by invoking the theme of water, is presented below:

When I was young I believed with all my heart
the Huleh swamp had to be drained.
Then all the bright-colored birds fled for their lives.
Now half a century later they are filling it with water again
Because it was all a mistake. Perhaps my entire life
I've been living a mistake.
And the God of my childhood, He too
is a mistake, though He is still called God.
But the perfect mistake makes a perfect life,
like perfect faith. The saying "Mistakes happen"
I've turned into a comforting song, and the verse

"All men are false" I've made into a dance tune by day,
a lullaby at night. Amen.[92]

As previously mentioned, *Now and in Other Days* was Amichai's first publication in 1955, forty-three years prior to *Open Closed Open*. The title of this poem makes a nod to this publication and suggests that Amichai may be reflecting on the difference between his opinions at the time he wrote *Now and in Other Days* and his philosophical state of the present-day. The opening lines of the poem indicate this by suggesting that the ideas that he had were those of a younger man. While Amichai doesn't yet state what change has occurred, the tense of the poem underscores that the change will be elaborated upon. The second part of the title and its reference to Psalms is a good example of how as Kronfeld observes, "Amichai's poetic signature…consists at least in part of his famous iconoclastic allusions to scared texts" and in this context the Book of Psalms, *tehillim*, is one of the three books of *Ketuvim*, the final section of the *Tanakh* (i.e. Hebrew scriptures).[93] While no longer the religious idealist of his youth, Amichai's reference to Hebrew scriptures gives rise to the possibility that the Jewish faith remains a crucial part of the national identity and therefore is worth preserving in his narrative. As this analysis will point out, the religious zeal of early immigrants to Israel were crucial to the establishment of the National Water Carrier and enabled humble Jewish villages to transform into flourishing cities.

In the first few lines of the stanza, Amichai reflects on the ideology of his younger self who was a devoted supporter of draining the Huleh swamp. The earliest Jewish settlement in the Huleh Valley (present-day Northern Israel) was developed in 1883 in a village called Yesud Hama'ala.[94] Following their immigration, the villagers found the land to be inhospitable and malaria-infested, and later Jewish settlements avoided the area altogether. A transfer of the Huleh drainage concession was made from the Syrian Ottoman Agricultural Company to the Palestine Land Development Company in 1934.[95] Following this acquisition, the Jewish National

Fund acquired 30,000 dunams in the valley, though most of the land was uncultivable.[96] After the creation of the State of Israel in 1948, the proper financial and political conditions were in place for the full-scale drainage of the swampland.

The goal of Zionist agencies was to transform this disease-stricken and flood prone valley with little arable land into a "veritable Garden of Eden" for the Jewish people of Israel.[97] The idea of braving malaria and creating a productive land out of these swamps was the stereotypical Zionist mission and is a theme that is reiterated in *The Blue Mountain* (1998), *They Were Ten* (1960), and other nationalistic narratives. However, as Amichai points out in line three, the transformation of the landscape was detrimental to the animals who lived in the swamps and saw their habitats destroyed. Yet this sacrifice was deemed essential for the development of the young nation. More than forty years later, the Huleh restoration project was created to moderate the effect of the draining of the marshes, which included deterioration of the soil and compromised agricultural sustainability.[98] In hindsight, the Zionist undertaking to drain the Huleh swamp did not live up to the romantic notions of Jewish nation-state building because it was not sustainable.

In line five, Amichai confronts the environmental tragedy that befell this region of Israel by admitting that the draining of the Huleh swamp was all a mistake. He thus relinquishes the ideals he embraced as a young man and wholeheartedly believed were the best option to ensure the Jewish population would thrive on the land. His reflection takes on a deeper meaning when he continues, "Perhaps my entire life / I've been living a mistake. / And the God of my childhood, He too / is a mistake, though He is still called God." As someone who was raised Orthodox and lived in Palestine at the height of the Zionist movement, Amichai was shaped by these two significant cultural forces. Following the revelations made in the poem regarding the

havoc wrought onto the environment, Amichai appears to be disillusioned to the point of questioning his own faith. However, rather than resenting God as a means of rebelling against the values that governed his childhood, he accepts that God is flawed. Even with these flaws, God's place in Amichai's understanding of the world does not change. Instead, "the perfect mistake makes a perfect life, / like the perfect faith." Amichai sees the mistake that were made at the hand of the Zionist mission to draining the swamps, but he doesn't disavow Zionism. Threatening the landscape's biodiversity and the nation's water supply was a costly mistake made in the name of Zionism, but Amichai acknowledges that it is the natural order of life to make mistakes. His view isn't to endorse this Zionist mission but he also doesn't explicitly renounce it. As elaborated upon in lines ten through thirteen, Amichai is not only resigned to these facts but he takes comfort in them.

Zionist groups, as Amichai was exposed to them, wanted to turn what they deemed were unhabitable spaces into communities for modern Jewish civilization despite the fact that many of these places were already inhabited by Palestinian Arabs or Bedouins. These Jewish groups sought to bring their European notions of what an ideal community looks like to Palestine. The reality of this dream was not only that the pioneers got sick from malaria and beautiful birds were forced to flee, but that the drainage of the swamp caused almost irreversible damage to the valley and raises the question of whether it should have occurred in the first place given the state of the valley today. Amichai's poem suggests that, while regrettable and wrong, these mistakes are what constitute the human condition. Amichai's perspective appears to be that it is natural and even encouraged to embrace disruption, and he has found a way to make his peace with the revelations made. In this poem, the role of water is to underscore how nature may be thrown out

of balance, but instead of this imbalance being viewed as a tragedy, it is seen as an inevitable fact of life that one should make peace with instead of regretting.

## III. Comparative Analysis of "A River Dies of Thirst" and "Once I Wrote *Now and in Other Days*: Thus Glory Passes, Thus Pass the Psalms"

In Darwish's "A River Dies of Thirst" the Jordan River takes on humanlike qualities, from its dependence on the heavenly mother to its appearance as a guest of villages and tents in the valley. These details provide a foundation for understanding why the tragedy of the river was devastating as it reiterates the loss of the Palestinian people in post-colonial spaces. The degradation of their community, while not explicitly stated, can be inferred due to the peoples' relationship with the river. The river served as an asset because it enabled the villagers to plant oleander trees and date palms in the valley. Without the ability to produce agriculture, a community is severely limited in their ability to function as an independent and prosperous society. If the villagers are engaged in this mutually beneficial coexistence with the river, and the river dies, then the villagers are effectively vulnerable. The anthropomorphizing of the river enables Darwish to contrast the Golden Age of a pre-colonial Palestinian society with a bleak future that is dependent with the fate of the river and therefore relies on the balance of nature to perpetuate.

On the other hand, while Amichai similarly engages with the concept of the natural order of things, he draws different conclusions than Darwish. Amichai does not anthropomorphize the Huleh swamp, but he acknowledges that the wetlands gave life to the bright-colored birds who made the ecosystem their home. Yet environmental concerns give way to political ideological ones and the nation-state is ultimately prioritized over the protection of nature. Unlike Darwish who has a clear stance on the sacrifice of nature, and sees an association between the

mistreatment of the river and the collapse of pre-colonial Palestine, Amichai's stance is more nuanced. The drainage of the Huleh swamp may have been a mistake because of the environmental damage that followed in the years to come, but making mistakes is fundamentally human. Amichai's position, as expressed in the poem, stresses that mistakes exist in every facet of life, even when they are made in the name of religion as was the case with the Zionist mission in the Huleh swamps.

Despite their differences in approaching imbalances in nature, Amichai's frame of mind is remarkably similar to Darwish, and it speaks to the ways in which water concerns constitute the national identity of both Palestinians and Israelis. Regarding the Israeli national identity, securing a national water source was fundamental to becoming self-sufficient in the region. Amichai's poem examines this pursuit with the awareness of the ecological sacrifices that were made. An approach to viewing the water concerns of Palestinians, as introduced by Darwish, largely deals with the access a community has to water sources. Depriving a population of water by way of restricting their control and access to water sources impedes all other aspects of their livelihood such as community health, food security, and economic stability.[99] According to one study done in Iran, it was determined that environmental changes may produce place-based distress in people witnessing the degradation of their environment and may consequently result in feelings of loss and trauma.[100] Another study done on farmers facing drought in Australia found that the farmers "perceived the degradation of their home environment not only as a threat to their subsistence, but also to their self-identity."[101] Darwish's poem articulates these exact sentiments as a way of understanding the Palestinian perspective on water resources. Taken together, these poems serve as lens through which one can understand the strong psychological connection between water and a nation's identity.

## Part III: Israeli Water Infrastructure

What began as a plan to extend water sources from the fertile land of Northern Israel to provide drinking water to the entire nation now supplies 1.5 billion cubic meters ($m^3$) of water to approximately seven million end users as of 2020.[102] The water carrier functions as a system of underground pipes, open canals, reservoirs, and tunnels. Mekorot, Israel's water supply utility, supplies 80 percent of Israel's drinking water and 70 percent of its total water use.[103] Israel, Palestine, and Jordan exist in a region with scarce rainfall. The rainy season lasts from November to March, with average rainfall between 400 to 800 millimeters (mm). in the northern and western regions of the country, and even lower rain volume in the southern area, including the Negev.[104] The dry season, which often lasts from April to October, is characterized by little rain.[105]

The Sea of Galilee is currently at record low levels despite the fact that the Israel Water Authority halted all operations to pump freshwater from the sea in 2013.[106] To augment supplies limited by rainfall and the demands of water users, Mekorot has supplemented freshwater through desalination plants, wastewater reclamation, drilling, stormwater catchment, and rain enhancement.[107] Desalination has become a primary freshwater source in Israel and therefore will be discussed in length in the following section. As of 2020, Mekorot operates all three command and control centers which track water quality, safety, and supply at various facilities nationwide. Such operations ensure water availability and efficiency of water distribution within the entire Israeli system.[108] Figure 3 illustrates the main water facilities controlled by Mekorot in Israel and speaks to coordination and efficient structure of the Israeli water system.

*Figure Three: Mekorot Water Facilities (2020)*


**Source: Mekorot. "Map of Main Water Facilities," n.d. https://www.mekorot.co.il/Eng/newsite/WaterManagementandSupply/Pages/MapofMainWaterFacilities.aspx and Rajesh. "*Developing the Desert: A Case Study of Israeli Infrastructure Privatization*."**

### *Wastewater treatment and reclamation*

Mekorot emphasizes water reclamation for agriculture as a means to reuse wastewater from households. Through the implementation of water reclamation, the company aims to divert

more freshwater to homes and reduce the ecological damage caused to the environment by untreated wastewater.[109] Israel reuses 630 million cubic meters ($m^3$) of effluent annually for irrigation with Mekorot treating 75 percent of the country's wastewater.[110] Wastewater reclamation has helped reduce groundwater contamination and has mitigated the disruption made to ecosystems by wastewater pollutants. Israel's "Third Pipeline to the Negev" delivers reclaimed water from the Shafdan Wastewater Treatment Plant in Tel Aviv to southern regions of the country.[111] Mekorot pumps the reclaimed water as needed by the agricultural farmers in the Negev. Farmers use drip irrigation which saves around 25 to 75 percent of water as opposed to flooding techniques.[112] Mekorot also treats the waters of the Yarkon with the support of the Yarkon River Authority, and the reclaimed water is reused for regional gardening and farming. The objective of the Yarkon River Rehabilitation project is to use the same drop of water three times: once at home, once at the Yarkon, and the third time in urban gardening and agriculture.[113] Water reclamation is an important process for the conservation of freshwater in light of pressure to the traditional water supply of the country. With considerable research and development, Mekorot seeks to address the issue of effluent discharge of which 100 million cubic meters ($m^3$) leaks into the environment each year.[114]

***Stormwater catchment and rain enhancement***

Mekorot's captures about 25 million cubic meters ($m^3$) of stormwater during an average year of rain.[115] In the event of a flashflood, as occurred in January of 2013, stormwater catchment collects the floodwater for either agriculture use or directs it into groundwater reserves. In recent years, Mekorot has invested in cloud seeding technology to increase rainfall, specifically in the north. This activity is reportedly led to an additional 30 to 40 million cubic

meters ($m^3$) per year for the Sea of Galilee.[116] Mekorot recently acquired a Polarimetric Doppler Weather Radar System which has the potential to increase the detection of rain clouds at a low cost per cubic meter.

### *Drilling*

While Israel has invested in water reclamation and desalination methods as an additional source of freshwater, groundwater remains crucial in meeting the demands of water users. Fluctuations in annual precipitation have significantly altered natural aquifer recharge rates.[117] Demand for water often exceeds the rates of replenishment of these aquifers, leading to the depletion of these water sources. Mekorot pumps water from shallow and deep layers of the aquifer and is currently working on the rehabilitation of fifty to sixty year old wells.[118] In recent years, Mekorot's Hydrology Department has conducted research in the field of artificial groundwater recharge with the intent of drilling injection wells into the coastal aquifer.[119] The aquifer will serve as a site for storing excess desalinated water in periods when there is a surplus in the system.[120] Since 2006, the Hydrology Department has cooperated with a German-Israeli-Jordanian-Palestinian commission working on integrating water resources in the lower Jordan Valley. The Sustainable Management of Available Water Resources with Innovative Technologies (SMART) program is a partnership of 17 institutions from these four regions designing a plan for artificial groundwater recharge through the infiltration of treated wastewater.

***Desalination***

In 2002, the government of Israel approved the construction of seawater desalination plants with the first plant built in Ashkelon in 2007.[121] As of 2020, Israel has built five desalination plants to alleviate Israel's chronic water shortage and meet the water needs of a growing population. As of 2019, nearly 70 percent of Israel's drinking water comes from these five coastal desalination plants.[122] While water conservation remains of the utmost importance, desalination has provided major relief to a country where droughts have become more frequent and severe. The five plants were financed through government partnerships with private sector companies IDE Technologies and Veolia who agreed to build and subsequently operate the plants for the 24 year and 11 month term of the contracts.[123] By outsourcing the construction and operations of the plants, the government was able to enlist the desalination expertise and financial capabilities of the private sector. In return, the Israeli government agreed to buying a fixed amount of water per year and providing a minimum payment for water supply. Such a partnership enabled the government to invest in large scale desalination without compromising the state's budget.

These plants desalinate through reverse osmosis (RO), where seawater is sent through a membrane, which filters salt molecules from pure water, and returns the salty solution to the sea. The RO membrane technique is energy-efficient because there is no evaporation process. Apart from seawater, the membrane process can be used to filter brackish water typically found in fossil aquifers in the Negev.[124] Household drinking water is therefore a combination of desalinated water, ground water, and treated surface water. The desalination era has propelled Israel's transformation into a water giant. According to Israel's Ministry of Finance, "seawater desalination is the most reliable of the sources for enriching the water supply, since seawater is

available in unlimited quantities and involves no dependency – neither on climate nor political factors."[125] Table 1 describes the output of Israel's desalination plants as well as their total output per year.

*Table One: Desalination Output in Israel (2020)*

| Desalination Plant | Annual Output in million cubic meters ($m^3$) |
|---|---|
| Palmachim | 90 |
| Ashdod | 100 |
| Ashkelon | 118 |
| Hadera | 127 |
| Soreq | 150 |
| Total Output | 585 |

**Source: table modeled after Rajesh. "*Developing the Desert: A Case Study of Israeli Infrastructure Privatization*." and based on data from "Israel Ministry of Finance - Seawater Desalination in Israel"**

### *Addressing environmental concerns of desalination*

As an effort to raise the water level of the Sea of Galilee, the Israeli government approved plans for a system of pumps that will reverse the direction of the National Water Carrier so that water from desalination plants in the south will flow north into the Sea of Galilee. The dangerously low water levels of the Sea of Galilee are especially precarious because of the problematic ecological outcomes. Water salinity and algae blooms both present potentially irreversible damage to water quality, various plant species, and animal life. This project, predicted to cost about $30 million, aims to turn the Sea of Galilee into a reservoir of desalinated water by laying more than 19 miles of new pipes.[126] Despite the promise of desalination systems in combating the effects of climate change, the technology is not without faults. According to

scientists, the environmental impacts of seawater desalination include "concentrate and chemical discharges to the marine environment, the emissions of air pollutants and the energy demand of the processes" which pose challenges for scientists who will need to determine how best to address these issues as the popularity of desalination plants increase worldwide.[127]

### *Water infrastructure and agriculture in Israel*

Water from the Ashkelon desalination plant is supplied to farmers in the northern Negev who cultivate salt-tolerant crops.[128] In 2010, fruit exports totaled $280 million with citrus fruits representing two-thirds of fruit exports.[129] Table 2 illustrates the water supply diverted to agriculture and the proportional usage of effluents for irrigation.

*Table 2: Agricultural water Supply in Israel (2010)*

| | *Total water supply* | *Agricultural supply* | *Reused wastewater* | | |
|---|---|---|---|---|---|
| *Calendar year* | MCM/YR | MCM/YR | MCM/YR | % OF TOTAL SUPPLY | % OF SUPPLY TO AGRICULTURE |
| 1965 | 1,329 | 1,075 | | | |
| 1970 | 1,564 | 1,249 | | | |
| 1980 | 1,700 | 1,235 | 80 | 4.7 | 6.5 |
| 1990 | 1,804 | 1,216 | 159 | 8.8 | 13.1 |
| 2000 | 1,924 | 1,138 | 269 | 14.0 | 23.6 |
| 2005 | 1,961 | 1,126 | 335 | 17.1 | 29.8 |

Source: Central Bureau of Statistics.

**Source: Ben-Gal, *Water Wisdom* "Sustainable Water Supply for Agriculture in Israel," 218.**

## Part IV: Transboundary Water Issues and Water Diplomacy

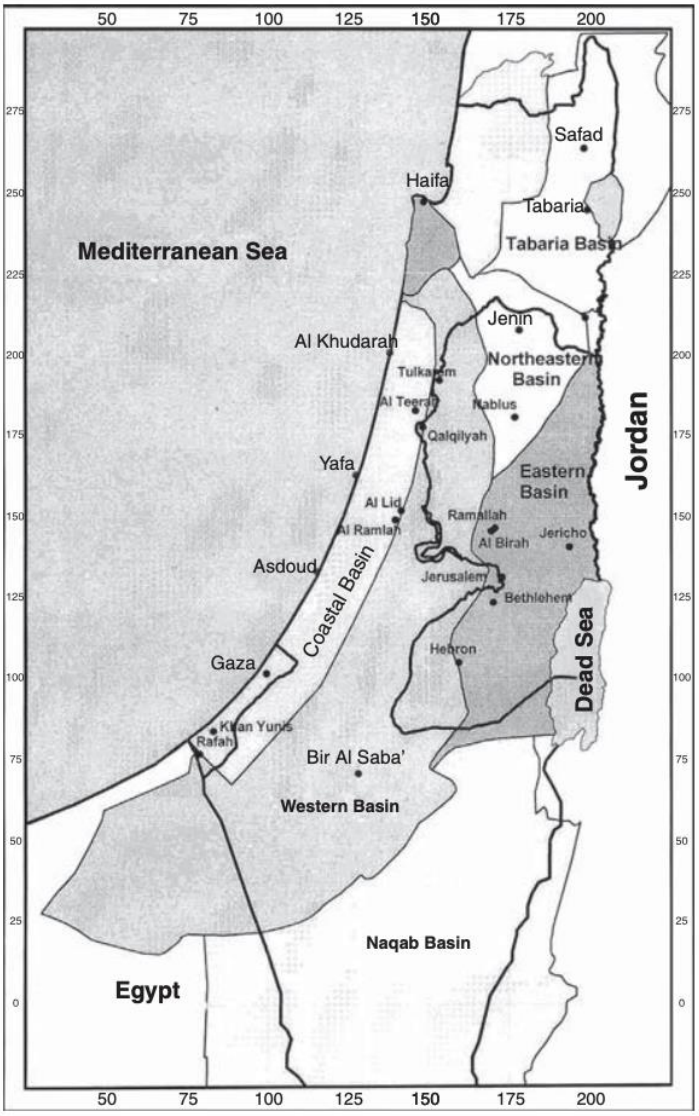
### *Water insecurity in Gaza*

Israeli water policy has far-reaching implications in the Jordan River basin with Palestinians being one group affected by the allocation of water sources in the region. The Gaza Strip is a water-scarce territory home to about two million Palestinian Arabs.[130] According to one scholar, in order to sufficiently meet Palestinian water needs, water quality and quantity must improve in this densely populated area.[131] A statement of need written in 2010 by Professor Yousef Abu-Mayla from Al-Azhar University and Professor Eilon Adar from the Ben-Gurion University of the Negev explains some of the issues faced by Gaza in this water crisis:

> The shallow groundwater reservoir underneath Gaza and the southern coastal plain of Israel is a unified cross-border or transboundary hydrological unit, which is already heavily contaminated by anthropogenic impacts and depleted to the level which leads to massive seawater intrusion. The local Coastal Aquifer provides the entire water supply to Gaza. In other words, groundwater from the local shallow aquifer is currently the only source of water to both domestic and agricultural sectors. The quality of this groundwater has deteriorated over the years, and extensive numbers of wells are being shut down due to low water quality, which falls below the minimum standards. A supply of high-quality water and prevention of soil and groundwater contamination is the most fundamental problem in this semi-arid environment of the Gaza Strip.[132]

Groundwater, which is allocated for both domestic and agricultural use, is decreasing in quantity due to extraction that exceeds the rainfall recharge rate, which is made up of 20 to 25 percent of rainfall.[133] As illustrated in Figure 4, the Gaza Strip primarily depends on one basin aquifer as opposed to the West Bank which derives water from four basin aquifers.

*Figure Four: Map of Palestinian Aquifers (2010)*



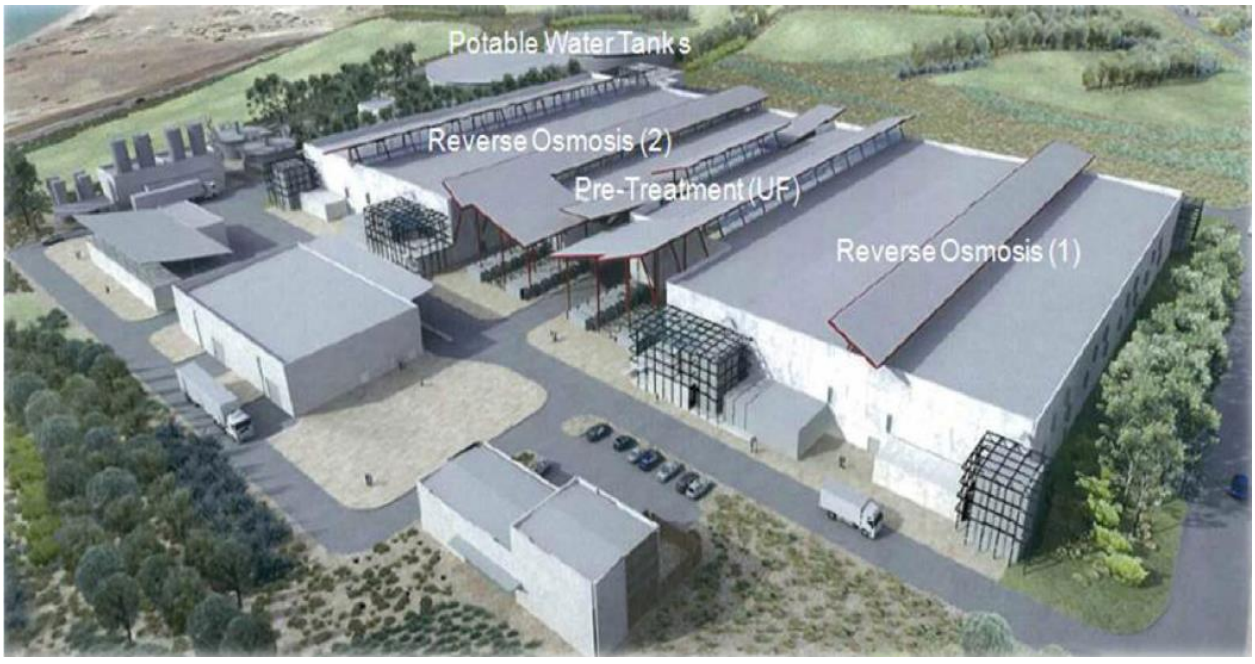

**Source: Aliewi, *Water Wisdom* "Water Resources: The Palestinian Perspective," 14.**

The storage capacity of the Coastal Aquifer is inhibited by asphalt and concrete which covers the land in urban areas and is difficult for water to penetrate. Water quality is affected by over pumping, contamination from agrochemicals, the leakage of sewage systems, and treated effluent-based irrigation.[134] The Coastal Aquifer has high concentrations of salinity, nitrates, and chlorides which are the result of thirty to forty years of intensive exploitation of the water source.[135]

***Addressing the Gaza Water Crisis***

Palestinian water use has historically been managed by local town or village-scale operations instead of a centralized system. One effort to mitigate Gaza's limited water is the "Desalination Facility for the Gaza Strip" project, which was started by the Union for the Mediterranean, an intergovernmental organization. Gaza desalination seeks to construct a large-scale seawater desalination plant with a capacity that will grow from 55 to 110 million cubic meters ($m^3$).[136] It will also construct a water carrier system that will distribute freshwater from the Northern Gaza Strip to the south and mitigate water loss throughout the system.[137] Figure 5 depicts the proposed design of the desalination plant as well as how the facility will operate the desalination process.

*Figure Five: The Desalination Facility for the Gaza Strip (2020)*




**Source: Image is from the *Union for the Mediterranean* "The 'Desalination Facility for the Gaza Strip' Project" Gaza Plant Factsheet.**

Desalination technology can provide major relief in a region which suffers from a lack of groundwater, but possesses a substantial supply of seawater and brackish water. The project, which began in 2018 and is expected to be completed in 2022, is estimated to cost about 562 million euros.[138] The project will create infrastructure to improve issues of water quality and quantity, reduce water pollution, and promote job creation. Funding commitments have come from Arab Gulf States, the European Commission, France, and Algeria.[139] The Gaza Central Desalination Plant is still in the process of being constructed, with the expectation that the plant will be up and running by June 2023.[140]

***The West Bank***

The West Bank territory is home to over 3 million Palestinian Arabs who use an average per capita water consumption of 50 liters per day.[141] Israeli settlements consume 35 million cubic meters ($m^3$) of water a year sourced from wells drilled in the West Bank and controlled by Israel.[142] In 2010, Palestinians in the West Bank purchased 25 million cubic meters ($m^3$) of water a year from Israel and 22 million cubic meters ($m^3$) of water a year from the West Bank Water Department.[143] That same year, Palestinian citizens sought to receive at least 100 liters per day at an affordable price, rather than the $1.25 per cubic meter in place.[144] Furthermore between 2011 to 2016, 60 percent of the water distributed to Palestinian households from the PWA was purchased from Mekorot.[145]

West Bank water quality has become an issue due to groundwater contamination resulting from years of industrial waste discharge, over pumping of aquifers, mishandling of raw sewage in Palestinian cities and Israeli settlements, and agrochemical runoff, which all leach into groundwater.[146] More than two-thirds of the West Bank relies on inadequately maintained septic

tanks rather than a sewage system connected to a wastewater treatment plant.[147] Disagreements between the Palestinian Water Authority and Israeli planning officials have hindered permanent solutions to addressing pollution problems in areas such as the Kidron Valley where sewage from both Israeli and Palestinian communities near Jerusalem flows into the West Bank.[148] The Palestinian Water Authority wishes to build its own wastewater treatment plant near the valley; progress has not been made on a joint wastewater plant.[149]

### *Palestinian Agriculture*

Historically, the Palestinian people have focused on the cultivation of rain-fed olive trees, citrus fruits, and olive oil production.[150] From the 19th century until 1948, the famously named "Jaffa oranges" made up one of the largest exports of oranges in the world. Thousands of Palestinian Arabs and Jews alike worked in the industry or the citrus groves which once surrounded Jaffa.[151] In 2010, sources of irrigation in the West Bank and Gaza Strip were groundwater wells and springs.[152] According to a study done by the Arab Development Society in Jericho, the wells have a high salt concentration that is only suitable for alfalfa and barley crops.[153] Salt-tolerant crops such as prickly pears, jojoba, melons, tomatoes, alfalfa, olives, almonds, and to some extent citrus and bananas, have become an attractive option because of such conditions.[154] As illustrated in Table 3, there has been a gradual change in the crop mix cultivated by Palestinians, with a decline of field crops and vegetables in the West Bank and an increase of the same crops in the Gaza Strip. In 2010, agriculture in the West Bank consisted primarily of rain-fed crops such as olives, grapes, almonds, plums, and stone fruits such as plums.[155]

*Table Three: Types of Agricultural Crops in the West Bank, Gaza Strip, and Palestinian Territories (1964-2006)*

| *Area* | *Type of agriculture* | 1964 | 1982 | 1995 | 2006 |
|---|---|---|---|---|---|
| West Bank | Field crops | 112,810 | 50,092 | 52,560 | 43,154 |
| West Bank | Vegetables | 27,113 | 13,904 | 13,650 | 13,643 |
| West Bank | Trees (olive and other) | 76,927 | 96,061 | 105,743 | 107,963 |
| Gaza Strip | Field crops | — | — | 3,755 | 6,447 |
| Gaza Strip | Vegetables | — | — | 6,125 | 5,697 |
| Gaza Strip | Trees (orange and other) | — | — | 8,617 | 5,706 |
| Palestinian Territories | Field crops | — | — | 56,315 | 49,601 |
| Palestinian Territories | Vegetables | — | — | 19,775 | 19,296 |
| Palestinian Territories | Trees (olive, orange, and other) | — | — | 114,360 | 113,669 |

Sources: 1964–1982 from Food Security Study (1985) by ASIR for FAO/ESCWA; 1999–2006 from Palestinian Central Bureau of Statistics Agricultural Statistics.

**Source: Assaf, *Water Wisdom* "Sustainable Water Supply for Agriculture in Palestine," 200.**

Table 4 provides the proportional break down of key crops in the West Bank and Gaza Strip. Olives have the highest production in the West Bank while oranges have the highest production in the Gaza Strip. The dominance of olive tree production in the West Bank explains why, in 2010, only 5 to 11 percent of cultivated land in the West Bank was irrigated.[156] In contrast, 73 percent of cultivated land in the Gaza Strip was irrigated during the same year.[157] Date palms are a promising crop for the Jordan Valley because their water consumption is low compared to other agriculture crops. Relative to other crops, the international price of dates is also high. As of 2016, date palm tree cultivation covered 1,584 hectares of Palestinian land.[158]

The trees are irrigated either through freshwater or treated water from the Jericho wastewater treatment plant and planted or rented land in the Jordan Valley.[159]

*Table Four: Key Crops in the West Bank, Gaza Strip, and Palestinian Territories (based on output, 2010)*

| | *Fruit trees* | | *Vegetables* | | *Field crops* | |
|---|---|---|---|---|---|---|
| *Area* | CROP | % OF TOTAL | CROP | % OF TOTAL | CROP | % OF TOTAL |
| West Bank | Olive | 53 | Cucumber | 27 | Wheat | 32 |
| | Grape | 19 | Tomato | 26 | Dry onion | 20 |
| | Lemon | 5 | Eggplant | 11 | Potato | 19 |
| Gaza Strip | Orange | 48 | Tomato | 41 | Potato | 56 |
| | Lemon | 11 | Cucumber | 17 | Dry onion | 18 |
| | Guava | 8 | Cut flower | 16 | Sweet potato | 11 |
| Palestinian | Olive | 45 | Tomato | 32 | Potato | 32 |
| Territories | Grape | 17 | Cucumber | 23 | Dry onion | 20 |
| | Orange | 12 | Eggplant | 9 | Wheat | 19 |

Source: Palestinian Central Bureau of Statistics Agricultural Statistics, 2006.

**Source: Assaf, *Water Wisdom* "Sustainable Water Supply for Agriculture in Palestine," 198.**

Although agricultural exports are currently not permitted from Gaza, there remains the possibility of the industry becoming an economic livelihood for Palestinians in the agrobusiness.[160] Ideally, only the most productive trees that use minimum amounts of water and can withstand salinity are planted. Table 5 illustrates the different fruit tree crops grown in the Jordan River basin and their corresponding water needs. Almond and jojoba tree crop cultivation

are two types of sustainable crops that could be planted in the water-scarce region. Both trees require little care, don't require expensive technology to cultivate or large quantities of water, mimic the maintenance of olives, and can withstand long periods of storage.[161] In the long term, scholars believe that such crops could potentially alleviate desertification and provide employment opportunities for Palestinians.[162]

*Table Five: Fruit Tree Crops in the Jordan River Basin (2010)*

| *Tree type* | *Total water needs in cubic meters per hectare* | *Water source* |
|---|---|---|
| Bananas | 200 | Irrigation |
| Avocadoes | 170 | Irrigation |
| Mangos | 160 | Irrigation |
| Date palm | 150 | Irrigation |
| Citrus | 120 | Irrigation |
| Guava | 100 | Irrigation |
| Figs | 48 | Rain fed |
| Olives | 40 | Rain fed |
| Apricots | 40 | Rain fed |
| Plums | 38 | Rain fed |
| Soft-shell almonds | 38 | Rain fed |
| Hard-shell almonds | 35 | Rain fed |
| Jojoba | 30 | Rain fed and/or supplemental irrigation |
| Cactus | 15 | Rain fed |

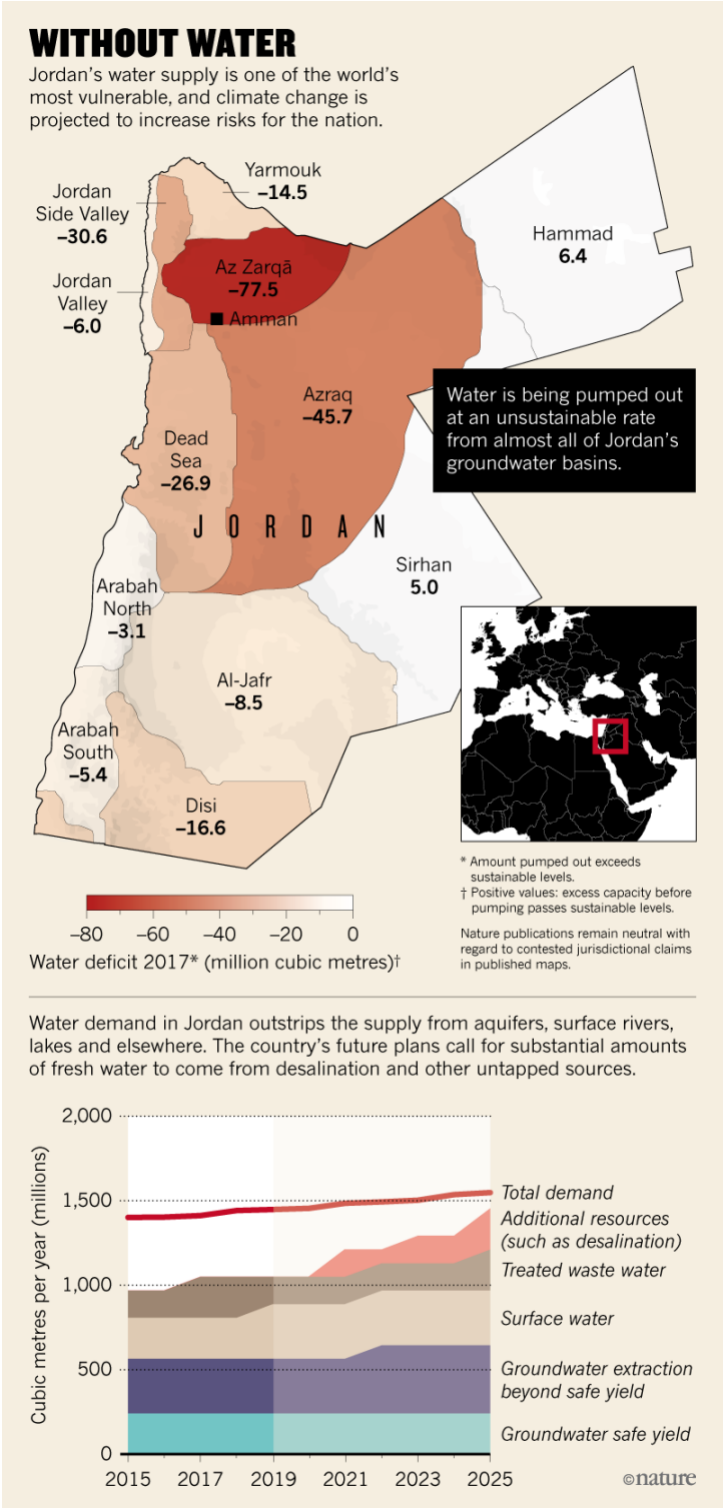
**Source: Assaf, *Water Wisdom* "Sustainable Water Supply for Agriculture in Palestine," 205.**

***Red Sea – Dead Sea Canal***

Jordan has historically relied heavily on groundwater as a source of freshwater, but underground water tables have lowered dramatically due to unpredictable rainfall, rising temperatures, and a growing population who requires more water to be pumped.[163] All of these factors result in supplies draining quicker than they can be replenished. Figure 6 illustrates how the Jordanian aquifers have transformed in recent years due to the effects of climate change. The growing Jordanian population includes Palestinian, Iraqi, and Syrian refugees who increase the stress put on the water supply. Jordan is currently one of the poorest nations in the Middle East in terms of water resources and risks exhausting its groundwater in the near future.[164] In addition to the aquifers, Jordan also depends on surface-water supplies from the Sea of Galilee and the Jordan River. Almost 45 percent of water extracted from these resources is for agricultural purposes.[165]

Marwan Al-Raggad, a Jordanian hydrogeologist, claims that one of Jordan's hopes for increasing their water supply is the Red Sea – Dead Sea Water Conveyance project with Israel.[166] The canal, planned for completion 2025, would bring desalinated water from the Red Sea to Amman with brine being diverted to the Dead Sea.[167] This project may alleviate some of the pressure currently placed on the Jordanian aquifers and would reduce rates of drilling. The canal would also address the issue of the Dead Sea, which is currently drying up due to diversion of Jordan River water.[168] However, agreements have stalled multiple times due to bureaucratic obstacles and it is unclear when negotiations will resume. Nevertheless, this partnership with Israel is just one example of how the threat of water scarcity can enable nations to cooperate in the face of climate change.

*Figure Six: The Vulnerability of Jordan's Water Supply (2019)*



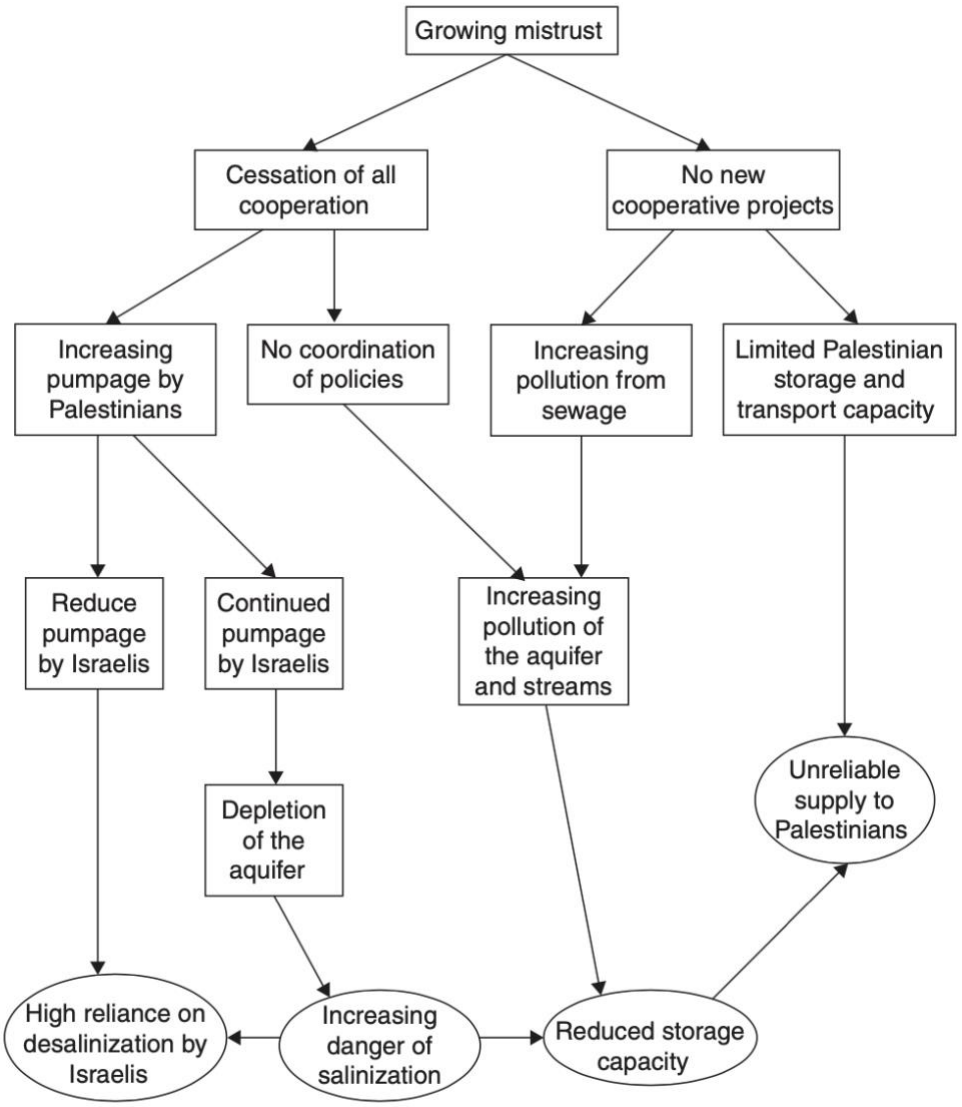

**Source: Elizabeth Whitman, "A Land without Water: The Scramble to Stop Jordan from Running Dry," 22.**

## Part V: Transboundary Water Solutions

Non-governmental organizations (NGOs) are uniquely situated to address issues in the water sphere. According to two scholars in the field, Professor Alon Tal from the University of Tel Aviv and Professor Alfred Abed Rabbo from the Bethlehem University, such organizations have specifically aided Palestinian communities by taking on the role that local governments might assume to centralize research operations and engage citizens.[169] A similar enthusiasm exists in Israeli circles with NGOs finding support among university programs, international donations, and the nation's government. Even more promising is the cooperation of Palestinian and Israeli water experts who combine their efforts to conduct joint research programs, symposiums, and other activities.

Partnerships in the water sector are especially appealing for Israeli and Palestinian water experts who have already begun to embrace a common perspective on transboundary water issues and environmental concerns. Figure 7 demonstrates issues caused by the continued separation of water management. In order to overcome these issues and address pressing environmental concerns related to the degradation of groundwater or inefficient wastewater management, it is crucial that Israelis and Palestinians combine their academic resources and create a structure that can support jointly managed projects. Previous successes of such initiatives include the installation of new wells in the West Bank, the expansion of piped water to more Palestinian communities in the West Bank, and the formation of community fora dedicated to improving water quality and quantity for Israelis and Palestinians.[170] This section will examine two possible institutions through which joint water projects between Palestinians and Israelis may take place, EcoPeace Middle East and the Arava Institute for Environmental Studies (AIES).

*Figure Seven: Problems Created by the Separation of Aquifer Management (2019)*




**Source: Feitelson and Haddad, *Water Wisdom* "Joint Aquifer Management," 315.**

### *EcoPeace Middle East*

EcoPeace Middle East was founded in 1994 with the purpose of uniting Israelis, Palestinians, and Jordanians who have the common goal of protecting their shared environment. Recognizing that the people of these three regions share the same groundwater and surface water

resources, EcoPeace encourages that regional cooperation be used to address environmental challenges when water resources are implicated. The organization operates out of three offices located in Tel Aviv, Ramallah, and Amman. It utilizes both top-down and bottom-up approaches including strategy based on research, publication of policy briefs, organization of events, and a grassroots strategy educating local communities about regional water solutions. Projects which fall under the top-down approach includes Water Cannot Wait, The Jordan Valley and Dead Sea initiatives, and the Water Energy Nexus (WEN).[171] The bottom-up approach includes projects such as Good Water neighbors, Jordan River Faith Based Initiatives, and the EcoCenter.[172]

The Water Cannot Wait project address the water crisis in Gaza and argues that natural water sources can be reallocated to Gaza at a low political cost, as since Israel depends on water from wastewater reclamation and desalination technologies. Between 2017 and 2021, EcoPeace Middle East hopes to "double the amount of water Israel sells to Gaza and to help secure sufficient electric power supply for wastewater treatment plants and to meet midterm water supply needs in Gaza through desalination."[173] The Jordan Valley and Dead Sea initiative aims to address the diversion of water from the Jordan River and the consequent destruction of the Dead Sea. Some targets of this plan are to rehabilitate the Jordan River by "promoting policy and legislation that would require mineral extraction companies to pay for the Dead Sea water that they extract, creating an economic incentive for investment in new sustainable management technologies for the Dead Sea."[174] Other targets include creating a donor-led trust fund for other Jordan Valley projects and researching the possibility of introducing desalinated water to the Sea of Galilee. Lastly, the Water Energy Nexus (WEN) is a regional project with the idea that Jordan supplies renewable energy to Israel and Palestinian territories and Israel and/or Gaza supplies Jordan with desalinated seawater.[175]

The bottom-up approach is concerned with engaging the local citizenry and encouraging community-based action. The Good Water Neighbors program was established in 2001 and currently include 14 communities in the Jordan River basin and 14 communities that share the Mountain and Coastal Aquifer.[176] These communities focus on biodiversity restoration, rehabilitating the ecosystems and water flow of the Lower Jordan River, cleaning up untreated wastewater and saline discharge in the Jordan River Valley, and advocating for an investment program signed by the three governments that will remove key sources of pollution. Figure 8 depicts a gathering of mayors, municipal representatives, and youths who jumped into the Yardenit baptism site to promote the rehabilitation of the Lower Jordan River.

*Figure Eight: EcoPeace Middle East "Big Jump in the Jordan River" (2010)*

**Source: "Seeds of Good Anthropocenes," n.d. https://goodanthropocenes.net/ecopeace-middle-east environmental-peacemaking-for-transboundary-water-management-in-israel-palestine-and-jordan/.**

Another community approach, the Faith Based Advocacy Program, attempts to use the symbolic and religious significance of the Jordan River to empower members of the local community to demand rehabilitation efforts for the Jordan. One of the biggest goals of this initiative involves gaining the support of the Pope and hold a public event demonstrating his support along with the support of Jewish and Muslim religious leaders.[177] To encourage youth participants, EcoPeace also parks for tourists and youth groups to learn about the experiments and projects currently run by EcoPeace Middle East and include parks such as the Sharhabil Bin Hassneh EcoPark in Jordan.[178]

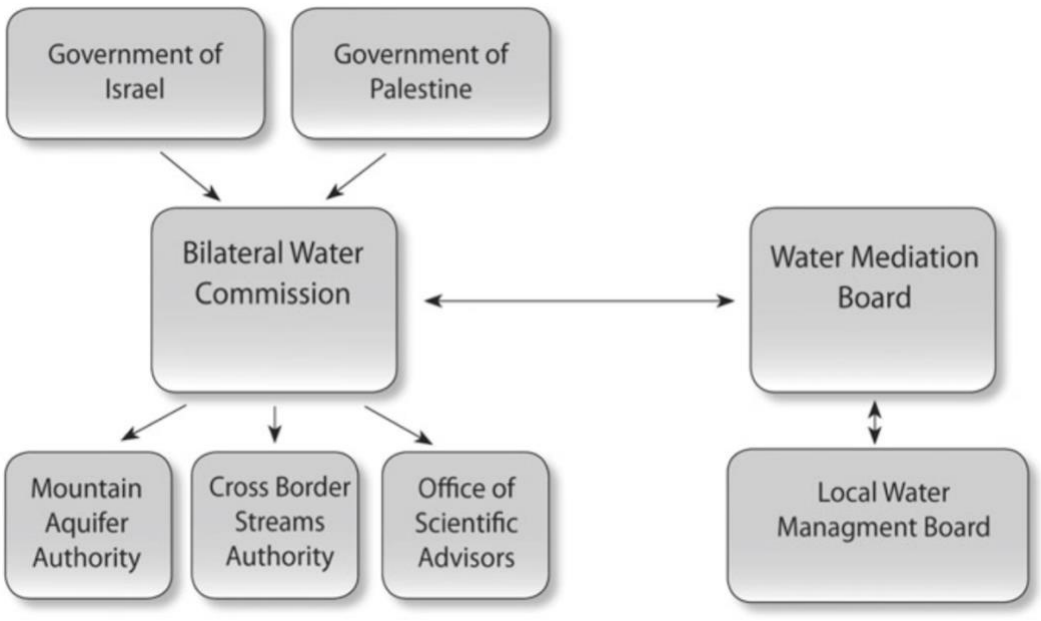
At the 2019 United Nations Security Council, EcoPeace Middle East presented their findings on the water crisis in the Palestinian Territories, specifically the Gaza Strip. Gidon Bromberg and Nada Majdalani, co-directors at EcoPeace Middle East, took turns speaking on the issue. Majdalani stated that "97 percent of groundwater in the Gaza Strip is not suitable for human consumption, adding that wastewater facilities cannot operate with an average daily power supply of just four hours."[179] Bromberg added to the conversation, stating that "good water, and not necessarily good fences, make good neighbors."[180] Concluding the talk, Bromberg added that "while Israelis and Palestinians used to fight for every drop of water, today desalination — fueled by solar power — has eased such constraints, he said, adding that cooperation on new technologies is a potential geopolitical game-changer."[181] Along these same lines, another optimistic development is the EcoPeace Proposal which is described by the following passage from *Transboundary Water Issues in Israel, Palestine, and the Jordan River Basin:*

> The essence of the EcoPeace Proposal is to recognize water as a flow and then to use continuous monitoring and ongoing mediation as the main management tools to achieve equity, efficiency and sustainability. These tools provide the basis

> for decisions to adjust withdrawals from each well or reservoir, or to modify use of water from a spring. They also encourage interaction between state and non-state actors. Ongoing mediation means that rulings or regulations can be appealed by any actor involved, whether scientist, officer of a non-governmental organization, or member of an agency that manages water. Social and economic developments over time can be accommodated and integrated within geologic, hydraulic, and engineering constraints.[182]

Figure 9 illustrates the organizational structure proposed by EcoPeace which is intended to replace the Joint Water Committee (JWC) established by Oslo II. The structure emphasizes shared responsibly by the two parties with advice supplemented from a mediation board which acts as an independent body.

*Figure Nine: Joint Management Structure from EcoPeace Proposal (2019)*




**Source:** ***Brooks, Trottier, and Giordano, Transboundary Water Issues in Israel, Palestine, and the Jordan River Basin: An Overview*****, 56.**

***The Arava Institute for Environmental Studies***

Since 1996, the Arava Institute operates out of Kibbutz Ketura in the Negev Desert and serves as an environmental teaching and academic research institute for students from Israel, Jordan, Palestine, the United States, Canada, and other locations around the world. Partnering with the Ben Gurion University of the Negev, students engage in projects while living on the kibbutz. Alumni in the program are remain involved in the field of water relations following their time at the Arava Institute with more than 800 alumni working in the environment.

Other projects of alumni involvement include transborder projects within Israel, working with the Palestinian Authority, and engaging in projects concerning the Dead Sea, river restoration, air quality, and ecosystem biodiversity. Figure 10 depicts a research group in the field and demonstrates the field work which occurs at the institute.

*Figure Ten: Research at the Arava Institute (Date Unknown)*

**Source: Arava Institute Center for Transboundary Water Management. "The Arava Institute," n.d. https://arava.org/about-our-community/for-the-press/**

The Center for Transboundary Water Management has seven ongoing projects: decentralized greywater treatment and reuse for rural communities, cross border stream restoration, dead sea basin research, CONSERVE, a center of excellence at the nexus of sustainable water reuse, food, and health, plastic pollution prevention in the Red Sea and Mediterranean Sea, off grid solar powered desalination, and green in med. The success of the program depends on "open dialogue that is made possible by the center enables the flow of data and, most importantly, establishes long-lasting relationships built on trust and integrity between those who are responsible for the sustainable management of the region's fragile water resources."[183]

The Track II Environmental Forum Conference organized by the Arava Institute aims to fosters communication in the community. In November of 2019, ninety-six participants gathered to discuss opportunities for renewable energy, the existing status of regional diplomacy, the role of civic society in fostering a shared water future, the development of the West Bank and Gaza, and any feedback from participants.[184] The nationalities represented at the conference were 55 percent Israeli, 15 percent international, 24 percent Palestinian, and 6 percent Jordanian.[185] The panel, facilitated by the Jordanian environment consulting firm iGreens, consisted of representative from the Israeli Ministry of Regional Cooperation, a former fellow of the Washington Institute for Near East Policy, and the current Head of Water and Environment Committee of the Arab Business Federation in Jordan.[186] One participant of the conference spoke about the escalation of environmental issues and the opportunities of local involvement.

> "We will see a change only when people start to really work together, believe each other, believe in the other side again…If we can solve one issue with local leadership, and then another issue, the changes that we can make will be bridges to build the peace that we want to see as soon as possible."

(MK Yael Cohen Paran speaks at the Track II Environmental Forum Conference, 2018)[187]

***Looking to the Future***

In this section, NGOs such as EcoPeace Middle East and the Arava Institute demonstrate an ability to unite Israelis and Palestinians as they tackle issues of water management. A recurrent message of these organizations, one which appeared in EcoPeace's presentation at the United Nations and the Arava Institute environmental forum, is for these two nations to confront shared water issues together. However, both organizations fail to explicitly address the differing Israeli and Palestinian perspectives on water resources and the circumstances from which they were born. When recalling Mahmoud Darwish's "A River Dies of Thirst" and Yehuda Amichai's "Once I Wrote *Now and in Other Days*: Thus Glory Passes, Thus Pass the Psalms," it is clear that Palestinians and Israelis possess contrasting water histories that influence how they consider the possibility of joint water management. The Palestinian relationship to shared water management is inextricably tied to a painful history of loss. Failing to address this grief isolates Palestinians in collaborative working spaces. The Israeli attitude towards shared water management recognizes that mistakes, such as the drainage of the Huleh swamps, were made in the creation of the State of Israel. Nevertheless, Israeli leaders believe that technological advancements of the present day, such as desalination, are the answer to fostering trusting relationships between Israelis and Palestinians. However, Darwish's poem suggests that Palestinian concerns are rooted in a tumultuous history, and earning their trust will require additional efforts. The most effective course of action must include a dialogue where Israeli participants can recognize the harm and violence experienced by Palestinian communities related to water use and control. Palestinian participants who desire solutions can decide if they will

accept this recognition and move forward in a collaborative manner. The outcome of these conversations is unclear, but what remains certain is that they are a necessity for addressing water issues in the region. EcoPeace and the Arava Institute will ideally serve as the vehicles for initiating this dialogue with programs focused on reconciling these two perspectives.

EcoPeace and the Arava Institute have remained engaged with their respective communities despite the suspension of large gatherings in Israel due to the COVID-19 pandemic. The Center for Transboundary Water Management has monitored the presence of the virus in wastewater as one form of predicting infection outbreaks.[188] In April of 2020, EcoPeace Middle East released a report encouraging cooperation on wastewater management. Recommendations include prioritizing the building of new wastewater treatment plants in the West Bank and Gaza with disinfectant processes, increasing the electricity supply in Gaza, and encouraging Israeli and Jordanian authorities to increase testing of the Jordan River for pollutants and SARS-CoV-2 virus.[189] Solving water management issues in the region can simultaneously address community health concerns and improve the livelihood of affected water users. While promising, the work of EcoPeace, the Arava Institute, and other regional organizations of water diplomacy must be supplemented with honest and sincere conversations that will allow for the cultivation of a long-term collaborative relationship between Israelis and Palestinians.

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## Biography

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